Project Introduction

A composite fatigue damage assessment and risk informed prognosis toolkit will be developed by enhancing and integrating existing solution modules within a probabilistic analysis framework. This tool will for the first time be able to address concurrently both microcracking induced stiffness degradation and cyclic loading induced delamination crack growth without remeshing. A physics-based deterministic solver will be developed by integrating a discrete crack network model with a multiaxial fatigue damage accumulation law. An advanced probabilistic analysis framework with the Bayesian Maximum Entropy (BME) updating procedure will be developed for risk informed total life management. The damage detection results will be integrated/fused with the physics based delamination growth prediction tool to form a risk informed damage prognosis and condition based maintenance metrics. Global Engineering and Materials, Inc. (GEM) has secured commitments for technical support from Clarkson University and Boeing, who will provide existing solution modules, supporting data, customization plug-ins, and expertise. The multi-faceted feasibility study consists of developing a method that will enable the prediction of multi-site, multi-mode damage interaction, extracting delamination driving force, characterizing delamination evolution under multiaxial non-proportional loading, and performing risk informed fatigue failure prediction and BME updating when new detection and maintenance data become available.

Primary U.S. Work Locations and Key Partners

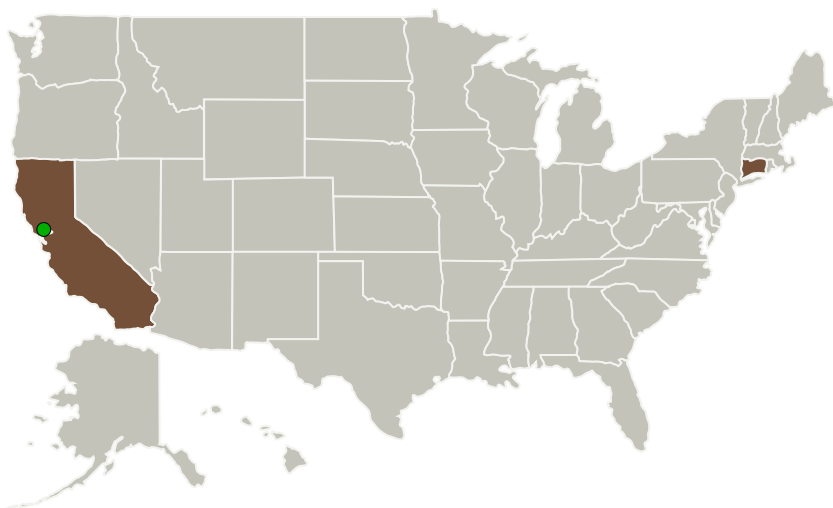Probabilistic Remaining Useful Life Prediction of Composite Aircraft Components, Phase I

Table of Contents

Organizations Performing Work	Role	Type	Location
Global Engineering and Materials, Inc	Lead Organization	Industry	East Lyme, Connecticut
●Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Connecticut

Project Transitions

▶ **February 2011:** Project Start

✔ **September 2011:** Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/140168)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Global Engineering and Materials, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:
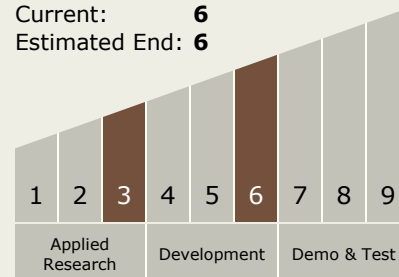
Yuanjie Lua

Co-Investigator:

Jim Lua

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**

1	2	3	4	5	6	7	8	9
		Applied Research		Development			Demo & Test	

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  └ TX12.1 Materials
     └ TX12.1.2 Computational Materials

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System